



Toolbox

Oral health and disease

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A healthy dentition and mouth is important to both quality of life and nutrition; oral disease may affect systemic health.

DEVELOPMENT OF DENTITION

Teeth form mainly from neuroectoderm and comprise a crown of insensitive enamel surrounding sensitive dentine and a root that has no enamel covering (figure 1). Teeth contain a vital pulp (nerve) and are supported by the periodontal ligament through which roots are attached into sockets in the alveolar bone of the jaws (maxilla and mandible). The fibers of the periodontal ligament attach through cementum to the dentine surface. The alveolus is covered by the gingivae, or gums, which when healthy are pink, stippled, and tightly bound down and form a close-fitting cuff with a small sulcus (gingival crevice) around the neck (cervical margin) of each tooth.

The primary (deciduous or milk) dentition comprises 4 incisors, 2 canines, and 4 molars in each jaw (total of 20 teeth). The normal permanent (adult) dentition comprises 4 incisors, 2 canines, 4 premolars, and 6 molars in each jaw (32 teeth) (figure 2).

Tooth development begins in the fetus at about 28 days in utero. Indeed, all the primary and some of the permanent dentition start to develop in the fetus. Mineralization of the primary dentition commences at about 14 weeks in utero, and all primary teeth are mineralizing by birth. The permanent incisors and first molars begin to mineralize at or close to the time of birth, while the other permanent teeth start to mineralize later. Tooth eruption occurs after formation and mineralization of the crown are largely complete but before the roots are fully formed (see table).

Summary points

- Tooth development begins in utero; root formation finalizes after eruption
- Full primary dentition has 20 teeth; full permanent dentition has 32 teeth
- Teething may cause irritability, drooling, and a small rise in body temperature
- Most tooth loss is due to caries, periodontal disease, or trauma
- Developing teeth can be damaged by infection, jaundice, metabolic disorders, drugs, and irradiation
- Most tooth discoloration is due to poor oral hygiene, diet, or habits

Neonatal teeth are uncommon and may be loose. They may damage the mother's nipple during suckling, in which case they may require removal.

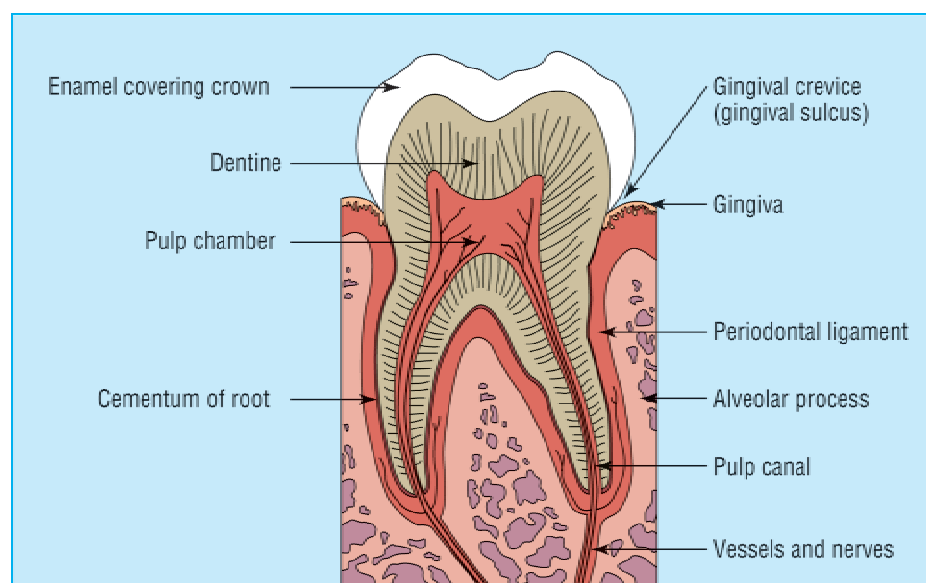


Figure 1 Diagram of a tooth and supporting structures



Figure 2 Healthy dentition, seen more frequently as caries rates decline

Average ages of tooth eruption

	Upper teeth	Lower teeth
Primary teeth	(months)	
Central incisors	8-13	6-10
Lateral incisors	8-13	10-16
Canines (cuspids)	16-23	16-23
First molars	13-19	13-19
Second molars	25-33	23-31
Permanent teeth	(years)	
Central incisors	7-8	6-7
Lateral incisors	8-9	7-8
Canines (cuspids)	11-12	9-10
First premolars (bicuspid)	10-11	10-12
Second premolars (bicuspid)	10-12	11-12
First molars	6-7	6-7
Second molars	12-13	11-13
Third molars	17-21	17-21

TEETHING

Eruption of primary teeth may be preceded by a bluish gingival swelling, usually a result of transient hematoma formation and, rarely, an eruption cyst that usually ruptures spontaneously. Tooth eruption may be associated with irritability, disturbed sleep, cheek flushing, drooling, elevated body temperature, or a circumoral rash, but it does not cause diarrhea or bronchitis (although these conditions may occur coincidentally).

DELAYS IN TOOTH ERUPTION

A delay in tooth eruption of up to 12 months may be of little or no importance in an otherwise healthy child. Delays often result from such local factors as a tooth in the path of eruption, insufficient space in the dental arch, or dental infection. Ectopic positioning and

impaction most often affect the third molars, second premolars, and canines, possibly because these are the last teeth to erupt.

More generalized failure of eruption is rare but may be associated with a variety of systemic causes (see box).

EARLY LOSS OF TEETH

Extraction because of dental caries or, in adults, periodontal disease is the most common reason for early tooth loss. Loss of teeth, particularly incisors, may also occur as a result of trauma, such as from sports, assaults, or other injuries.

Unexplained early tooth loss in children or adults may be a feature of diabetes; genetic defects, such as Down syndrome, Papillon-Lefèvre syndrome (palmoplantar hyperkeratosis), juvenile periodontitis and related disorders, Ehlers-Danlos syndrome type VIII, eosinophilic granuloma; immune defects, such as neutropenia, neutrophil defects, monocyte defects, interleukin-1 abnormali-

ties, human immunodeficiency virus infection, and AIDS; or enzyme defects, such as acatalasia (absent catalase) or hypophosphatasia (low alkaline phosphatase).

VARIATIONS IN TOOTH NUMBER

Teeth missing from the normal dentition may have failed to develop (hypodontia) or to erupt, or they may have been lost prematurely.

Hypodontia

This somewhat common condition is probably of genetic origin (figure 3). The teeth most often missing are the third molars, second premolars, and maxillary lateral incisors; other teeth may be reduced in size. Several teeth may be absent in patients with Down syndrome and ectodermal dysplasia.

Mixed dentition

When permanent teeth erupt before the primary incisors have exfoliated, it is common to see what seems to be 2 rows of teeth in the lower incisor region. This configuration is especially likely to occur when the space for the larger permanent teeth is inadequate. The situation usually resolves as primary incisors are lost and the mandible grows.

Supplemental or extra teeth are uncommon. Of unknown cause, they are most often seen in the regions of the maxillary lateral incisors, premolars, and third molars. Additional teeth of abnormal form (supernumerary teeth) are also rare (figure 4). Usually small and conical, supplemental teeth are often seen in the maxillary midline where they may remain unerupted and may cause impaction of a permanent incisor. Additional teeth often occur alone in otherwise healthy individuals but occasionally occur in associa-

Causes of delayed tooth eruption

Local factors

- Impacted teeth
- Iatrogenic causes
- Cytotoxic therapy
- Radiotherapy
- Uncommon or rare systemic causes
- Down syndrome
- Cleidocranial dysplasia
- Congenital hypopituitarism
- Congenital hypothyroidism
- Gaucher disease
- Osteopetrosis



Figure 3 Many permanent teeth are missing, including upper lateral incisors and lower central incisors (hypodontia)



Figure 4 Supernumerary teeth are erupting palatal to upper central incisors

tion with rare disorders such as cleidocranial dysplasia and Gardner syndrome.

TOOTH SIZE, SHAPE, STRUCTURE, AND COLOR

A variety of local and generalized factors may affect tooth formation or mineralization. Although tooth development in utero is generally well protected, it may be affected by maternal disease and intrauterine infection (rubella and cytomegalovirus) and by systemic disturbance during early life. The classic hutchinsonian incisors and Moon's (or mulberry) molars of congenital syphilis are rarely seen in developed countries.

Between birth and 6 years of age, the permanent teeth, particularly those of cosmetic importance, may be damaged (figure 5). Upper permanent incisors may show defects as a consequence of trauma to the primary predecessor. Local infection or trauma may cause a defect in a single tooth or group of teeth. Lower premolars that are malformed because of periapical infection of their primary predecessors are termed "Turner's teeth." More generalized defects may be associated with the occurrence of systemic disorders (prematurity, infections, jaundice, malabsorption, and cytotoxic therapy) during tooth forma-



Figure 5 This upper central incisor is discolored as a result of injury to the primary predecessor during development of the permanent tooth



Figure 6 The upper left lateral incisor is small and conical (microdontia)

tion and mineralization, the defect relating to the timing, severity, and duration of the disorder.

Teeth, especially the third molars, may vary in size, form, and structure because of genetic factors. Microdontia (teeth smaller than usual) is largely of genetic origin and usually affects the lateral incisors, which are conical or peg-shaped (figure 6). Teeth that are larger than normal (megadont) are uncommon. Double teeth occur occasionally, most often in the primary dentition. In the succeeding permanent dentition, they are likely followed by extra tooth elements.

Superficial tooth discoloration is usually caused by poor oral hygiene or habits, such as smoking or consuming certain foods and beverages, such as tea. Discoloration is also associated with use of some medications, such as iron or antimicrobial agents. In some cultures, chewing betel causes staining. Discoloration of a single tooth usually indicates that the tooth is nonvital, heavily filled, or carious.

Intrinsic brown or gray staining may be caused by tetracycline use in women during pregnancy or lactation and in children younger than age 8 years. Excessive fluoride ingestion during early life may also result in enamel opacities, but except in those parts of the world where water supplies contain high

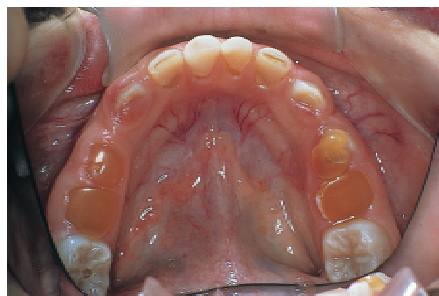


Figure 7 This patient with osteogenesis imperfecta also shows dentinogenesis imperfecta

Causes of tooth discoloration

Extrinsic discolorations (typically brown or black)

- Poor oral hygiene
- Cigarette and other tobacco products
- Food and drink, such as tea, coffee, red wine
- Medication, such as iron, chlorhexidine, antimicrobial agents
- Betel chewing

Intrinsic discolorations

Localized factors

- Trauma (yellow to brown)
- Caries (white, brown, or black)
- Restorative materials (such as black of amalgam)
- Internal resorption (pink spot)

Generalized factors

- Tetracyclines (brown)
- Excessive fluoride (white or brown)
- Rare causes
 - Amelogenesis imperfecta (brown)
 - Dentinogenesis imperfecta (brown or purple)
 - Kernicterus or biliary atresia (green)
 - Porphyria (red)

levels of fluoride, these changes are usually mild.

Enamel and dentine defects of genetic origin are rare. Occasionally, they are severe and may vary in their forms and in the pattern of inheritance. Such defects can occur in isolation—as amelogenesis imperfecta (defective enamel) or dentinogenesis imperfecta (defective dentine)—or in association with a disorder such as epidermolysis bullosa dystrophica or osteogenesis imperfecta (figure 7).

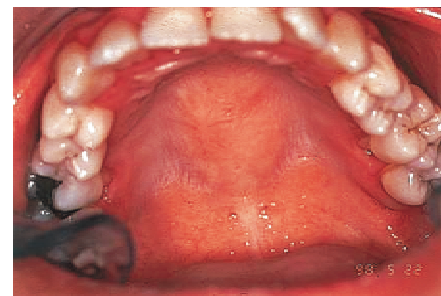


Figure 8 A large torus seen at midline on the palate is characteristic of torus palatinus

ANATOMIC VARIANTS

Patients sometimes are concerned after noticing various anatomic variants in the mouth.

Tori and exostoses

These bony lumps appear during tooth development and are especially common in people of African or Asian ancestry. Torus mandibularis consists of bilateral, asymptomatic, benign bony lumps lingual to the lower premolars. Also common is torus palatinus, a slow-growing, asymptomatic, benign bony lump in the midline of the palate (figure 8). No treatment is needed. Occasionally, these lumps are excised or reduced if they cause severe difficulties with dentures.

Sebaceous glands

Probably 50% to 80% of the population has creamy-yellow dots (Fordyce spots) along the border between the lip vermillion and the oral mucosa (figure 9). They usually are not clinically evident until after the age of 3 years.



Figure 9 Fordyce spots are sebaceous glands close to the vermilion border between the lip and buccal mucosa

These glands increase in number during puberty and then again in later adult life. They are totally benign, although some patients or physicians mistake them for thrush or lichen planus. No treatment is indicated other than reassurance.

Foliate papillae

The size and shape of the foliate papillae on the posterolateral margins of the tongue are

variable. These papillae occasionally swell if irritated mechanically or if the patient has an upper respiratory tract infection. Located at a site with a high association with lingual cancer, they may give rise to anxiety about cancer.

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Further reading

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Netphiles

Abstinence

Is virginity the new rock 'n' roll? You'd think so, listening to pop stars and politicians preaching the gospel of celibacy. A prime example is Britney Spears, who tirelessly publicizes her abstinence. Odd then that there is no mention of it on her "official" web site (www.britneyspears.com). Unofficial sites offer the exciting news that a genetically modified, and presumably chaste, chicken has been named after her. An excruciating fictional encounter between the pop star and Harry Potter is at www.gtexts.com/rantzone/7_9_00_2.html.

Trevor Stammers recently argued in the *BMJ* that doctors should advise adolescents to avoid sexual intercourse (*BMJ* 2000; 321:1520-1522). He will, of course, find many allies on the web. The National Abstinence Clearinghouse, at www.abstinence.net, promotes "the appreciation for and practice of sexual abstinence (purity) until marriage." There are no prizes for guessing the message of www.abstinencebetterchoice.com. Perhaps the most famous US abstinence campaign is "True Love Waits," whose web site (www.truelovewaits.com) tries far too hard to look hip ("We're cool! We're connected! We're seizing the Net!")

Amid the poems by teenagers extolling the virtues of "sexual purity," many of these sites show photographs of unborn children, and there's even a video of a termination of pregnancy. Here then is a more dubious side of these abstinence campaigns: less to do with sexual health promotion and more to do with religious or moral agendas, which can impede the provision of comprehensive sex education. Sex education in the United States has become increasingly focused on abstinence at the expense of educating children about safe sex, contraception, sexual identity, and communication and negotiation skills (www.agi-usa.org/pubs/journals/3220400.html).

When it comes to effective models of sex education, we can look to the Nordic countries, which even have a resolution on adolescent sexual health and rights (www.citizen2000.net/annex6.html). The resolution is refreshingly pragmatic, accepting "the fact that young people are sexually active" and making "a serious commitment to address their needs, placing great emphasis on preventive work."

Gavin Yamey

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We welcome suggestions for web sites to be included in future Netphiles